

## Draft Terms of Reference – Silvery Marmoset

- **Provide information on the taxonomy of the species**

Kingdom: Animalia

Phylum: Chordata

Class: Mammalia (mammals)

Order: Primates (monkeys and apes)

Suborder: Haplorrhini (New World primates)

Family: Cebidae (New World monkeys)

Subfamily: Callitrichinae (marmosets and tamarins)

Genus: *Mico*

Species: *argentatus*

Synonym: *Callithrix argentata*

Common name: Silvery Marmoset

Alternative common names: Silver Marmoset

The Silvery Marmoset was first described by Linnaeus in 1766 as *Simia argentata*.<sup>1</sup> The species was formerly in the genus *Callithrix* (along with all other marmosets, now divided between three or four distinct genera), but is now almost-universally placed in the genus *Mico*, which was previously treated as a subgenus of *Callithrix*.<sup>2,3,4</sup> The IUCN considers the species to be in the genus *Mico*,<sup>5</sup> while CITES still lists it as *Callithrix argentata* (with *Mico argentatus* as a synonym).<sup>6</sup>

Rylands *et al* (2009)<sup>7</sup> gives a good overview of the changing taxonomy of callitrichid genera and species. Garbino (2015)<sup>8</sup> and Garbino and Martins-Junior (2018)<sup>9</sup> are more recent reviews of genera.

The subfamily Callitrichinae (marmosets and tamarins) has usually been subsumed into Cebidae as a subfamily, as in Wilson & Reeder (2005)<sup>10</sup> and Garbino (2015).<sup>11</sup> CITES also still includes the family under Cebidae.<sup>12</sup> Equally commonly it is elevated to a full family, Callitrichidae, as in e.g. Rylands *et al* (2009)<sup>13</sup> and Buckner *et al* (2015).<sup>14</sup>

There are no currently-recognised subspecies of Silvery Marmoset.<sup>15</sup> However several full species were formerly treated as conspecific, either as colour morphs or as subspecies, including *Mico emiliae* (formerly considered to be a dark morph of the Silvery Marmoset),<sup>16</sup> *Mico intermedius*, *Mico leucippe*, and *Mico melanurus*.<sup>17,18</sup> Today fourteen species of *Mico* are recognised,<sup>19,20</sup> most of which were formerly considered to be subspecies of either *Mico argentatus* (Silvery Marmoset) or *Mico humeralifera* (Tassel-eared Marmoset).

The Silvery Marmoset does not appear to have any alternative common names other than Silver Marmoset, although the split species usually had independent names (e.g. Black-tailed Marmoset for *Mico melanurus*).

<sup>1</sup> Groves, C. (2001) "*Primate Taxonomy*" Smithsonian Institution

<sup>2</sup> Rylands, A.B., A.F. Coimbra-Filho, and R.A. Mittermeier (2009) "The Systematics and Distributions of the Marmosets (*Callithrix*, *Callibella*, *Cebuella*, and *Mico*) and Callimico (*Callimico*) (Callitrichidae, Primates)", pp. 25-61, in Ford, S.M., L.M. Porter, and L.C. Davis (eds) "*The Smallest Anthropoids: The Marmoset/Callimico Radiation*", Springer US (Available online here: [https://www.researchgate.net/publication/226274866\\_The\\_Smallest\\_Anthropoids](https://www.researchgate.net/publication/226274866_The_Smallest_Anthropoids))

- <sup>3</sup> Garbino, G.S.T. (2015) "How many marmoset (Primates: Cebidae: Callitrichinae) genera are there? A phylogenetic analysis based on multiple morphological systems" *Cladistics* vol. 31 (6), pp. 652-678
- <sup>4</sup> Garbino, G.S.T., and A.M.G. Martins-Junior (2018) "Phenotypic evolution in marmoset and tamarin monkeys (Cebidae, Callitrichinae) and a revised genus-level classification" *Molecular Phylogenetics and Evolution* vol. 118, pp. 156-171
- <sup>5</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>
- <sup>6</sup> CITES page for "Callithrix argentata": <https://cites.org/eng/node/20263>
- <sup>7</sup> Rylands *et al* (2009), *op. cit.*
- <sup>8</sup> Garbino (2015), *op. cit.*
- <sup>9</sup> Garbino and Martins-Junior (2018), *op. cit.*
- <sup>10</sup> Wilson, D.E., and D.M. Reeder (eds) (2005) "Mammal Species of the World: a taxonomic and geographic reference" (3rd edition), John Hopkins University Press
- <sup>11</sup> Garbino (2015), *op. cit.*
- <sup>12</sup> CITES page for "Callithrix argentata": <https://cites.org/eng/node/20263>
- <sup>13</sup> Ryland *et al* (2009), *op. cit.*
- <sup>14</sup> Buckner, J.C., J.W. Lynch Alfaro, A.B. Rylands, and M.E. Alfaro (2015) "Biogeography of the marmosets and tamarins (Callitrichidae)" *Molecular Phylogenetics and Evolution* vol. 82, pp. 413-425
- <sup>15</sup> Wilson and Reeder (2005), *op. cit.*
- <sup>16</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>
- <sup>17</sup> Wilson and Reeder (2005), *op. cit.*
- <sup>18</sup> Rylands *et al* (2009), *op. cit.*
- <sup>19</sup> Garbino and Martins-Junior (2018), *op. cit.*
- <sup>20</sup> Petter, J., and F. Desbordes (2010) "Primates of the World" Editions Nathan

- **Provide information on the status of the species under CITES**

**CITES Listing:** Appendix II

**IUCN Red List Status:** LC (Least Concern)

The Silvery Marmoset is listed by CITES, under the scientific name *Callithrix argentata* (with *Mico argentatus* as a synonym), on Appendix II<sup>21</sup> which permits trade when issued with an export permit. The species is listed by the IUCN as LC (Least Concern).<sup>22</sup>

The Silvery Marmoset has a fairly restricted range in northeastern Brazil. Concalves *et al* (2003)<sup>23</sup> describe the species' distribution as being bounded by the Amazon River to the north, the Tapajós River to the west, and the Tocantins River to the east. The IUCN describe the species' distribution as "south of the Rio Amazonas ... between the mouth of the Rio Tocantins in the east and the Rios Tapajós and Cuparí (an eastern tributary) in the west, extending south to the Rio Iirí as far as the lower Rio Curuá."<sup>24</sup>

Total population figures appear to be unknown but the species is considered common within its range and it apparently thrives in disturbed forest.<sup>25</sup> However the IUCN also states that the main threat to the species is habitat loss, with conversion of forest to cattle pasture and other agricultural uses.<sup>26</sup> The IUCN notes that it occurs in at least two protected areas, the Tapajós National Forest and the Caxiuanã National Forest.<sup>27</sup>

<sup>21</sup> CITES page for "Callithrix argentata": <https://cites.org/eng/node/20263>

<sup>22</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>

<sup>23</sup> Convaless, E.C., S.F. Ferrari, A. Silva, P.E.G. Coutinho, E.V. Menezes, and M.P.C. Schneider (2003) "Effects of Habitat Fragmentation on the Genetic Variability of Silvery Marmosets *Mico argentatus*" pp. 17-28, in Marsh, L.K. (ed) "*Primates in Fragments: Ecology and Conservation*" Springer

<sup>24</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>

<sup>25</sup> Convaless *et al* (2003), *op. cit.*

<sup>26</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>

<sup>27</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>

- **Provide information about the ecology of the species.**

Silvery Marmosets have been recorded as living almost 17 years in captivity. Weigl (2005)<sup>28</sup> gives a record of a female living for 16.5 years, and Hakeem (1996)<sup>29</sup> has a record of a wild-caught female living for 15.2 years, with the note that the true age could have been up to 16.8 years.

Petter and Desbordes (2010)<sup>30</sup> give the measurements of the Silvery Marmoset as a head-body length of 21cm and tail length of 30-32cm. Weight is given in the same source as 320 grams for females and 357 grams for males. The sexes of all species of callitrichids can be easily determined by examination of the external genitalia.<sup>31</sup> In general appearance all callitrichids are monomorphic (male and female are similar in colour and size).<sup>32,33</sup> It has been noted that individuals in captive populations tend to have larger body-weights (increasing over captive generations) than individuals in wild populations.<sup>34</sup>

The Silvery Marmoset is entirely white in colouration apart for the black tail and pale (yellow to pink) face and ears. It is easily distinguished from all other species of callitrichids simply by colouration. Several other species of *Mico* marmosets (formerly considered subspecies of the Silvery Marmoset) are also partially-white or even fully-white, but the additional coloured areas in these species are either in a different pattern or in a different colour (e.g. brown). There is only one other species of callitrichid in which the fur is entirely white, the White Saddleback Tamarin (*Saguinus melanoleucus melanoleucus*), but in that species the face is black and hence it is immediately differentiated. All callitrichids are easily differentiated from other families and species of monkeys by virtue of their small body-size. All species of marmosets and tamarins are illustrated for comparative purposes in Rylands *et al* (2008)<sup>35</sup> and Mittermeier *et al* (2013).<sup>36</sup>

The Silvery Marmoset has a fairly restricted range in northeastern Brazil. Concalves *et al* (2003)<sup>37</sup> describe the species' distribution as being bounded by the Amazon River to the north, the Tapajós River to the west, and the Tocantins River to the east. The IUCN describe the species' distribution as "south of the Rio Amazonas ... between the mouth of the Rio Tocantins in the east and the Rios Tapajós and Cuparí (an eastern tributary) in the west, extending south to the Rio Iirirí as far as the lower Rio Curuá."<sup>38</sup>

Within this distribution the species is found in a range of forest types, including primary forest, secondary forest, open forest, and remnant forest patches in savannah.<sup>39</sup> They cannot survive in or travel across open grassland in the absence of tree cover. There may be interspecific competition in areas where they live sympatrically with other callitrichid species, as described in Ferrari (1993)<sup>40</sup> with regards to the Black-handed Tamarin (*Saguinus niger*).

The species is sedentary (non-migratory) and, as with all higher Primates, does not hibernate or aestivate. Their area of distribution is in the lowland tropics of northeastern Brazil, less than 100 metres above sea-level, where there is a monsoonal climate. Annual average temperatures are above 26 degrees Celsius, and the annual rainfall is 2800-3100mm.<sup>41</sup> Although they occur in riparian

strips (forest fringing rivers and other waterways) and in seasonally-flooded forests, they are not dependant on waterways and, as an arboreal species, occur in many different forest types sited away from water bodies.<sup>42</sup> One study of the forest use of a single group of Silvery Marmosets over the course of eleven months showed that for 78% of the time they utilised secondary growth forest, and only 9% of the time was spent (partly) in flooded forest.<sup>43</sup> Digby *et al* (2007) give home ranges of between 4 and 35 hectares for individual groups.<sup>44</sup>

Based on captive studies, all callitrichids (marmosets and tamarins) have traditionally been thought to have a broadly-similar social structure, with groups being formed from a single mated pair and their (non-breeding) adult offspring from previous births. Field studies, however, suggest that in the wild callitrichids may actually be highly-variable in social structure. Wild studies have shown that various species may live in social groups that are monogamous (a single mated pair), polyandrous (multiple breeding males), polygynous (multiple breeding females), or polygamous (multiple breeding males and females). These social structures may differ between genera (e.g. *Callithrix* [marmosets] versus *Saguinus* [tamarins]), between species or between geographically-separate populations of the same species, or even change in a single group over time.<sup>45,46</sup>

For Silvery Marmosets specifically, wild animals have been recorded as living in "extended family groups", with group sizes of between four and fifteen individuals.<sup>47</sup> In Digby *et al* (2005) typical group size is given as six to ten animals, comprising from one to three adult males and one to two adult females.<sup>48</sup>

Callitrichid groups are territorial towards other groups of conspecifics (members of their own species) but regularly form mixed feeding groups with other species. In the Silvery Marmoset *sensu lato*, mixed groups have been recorded as occurring in the wild with various tamarin species, including *Saguinus fuscicollis*, *S. imperator*, *S. labiatus*, *S. mystax*, and *S. nigricollis*.<sup>49</sup>

Callitrichids have small sharp claws and sharp teeth, and are capable of inflicting minor wounds on humans. However the very small size of the animals prevents serious injuries.<sup>50</sup>

<sup>28</sup> Weigl, R (2005) "*Longevity of Mammals in Captivity; from the living collections of the world*" Kleine Senckenberg-Reihe 48

<sup>29</sup> Hakeem, A., R. Sandoval, M. Jones, and J. Allman (1996) "Brain and life span in primates" pp.78-104, in Birren, J. (ed.) "*Handbook of the Psychology of Aging*" Academic Press

<sup>30</sup> Petter, J., and F. Desbordes (2010) "*Primates of the World*" Editions Nathan

<sup>31</sup> Hubrecht, R., and J. Kirkwood (2010) "*The UFAW Handbook on the Care and Management of Laboratory and Other Research Animals*" Universities Federation for Animal Welfare

<sup>32</sup> Tardif, S.D., M.L. Powe, C.N. Ross, J.N. Rutherford, D.G. Layne-Colon, and M.A. Paulik (2009) "Characterization of Obese Phenotypes in a small Nonhuman Primate, the Common Marmoset (*Callithrix jacchus*)" *Obesity* vol. 17 (8), pp. 1499-1505

<sup>33</sup> Strier, K.B. (2016) "*Primate Behavioral Ecology*" Routledge

<sup>34</sup> Tardif *et al* (2009), *op. cit.*

<sup>35</sup> Rylands, A., R.A. Mittermeier, A.F. Coimbra-Filho, and E.W. Heymann (2008) "*Marmosets and Tamarins: pocket identification guide*" Conservation International

<sup>36</sup> Mittermeier, R.A., A.B. Rylands, D.E. Wilson (eds) (2013) "*Handbook of the Mammals of the World, volume 3: Primates*" Lynx Edicions

<sup>37</sup> Consoles, E.C., S.F. Ferrari, A. Silva, P.E.G. Coutinho, E.V. Menezes, and M.P.C. Schneider (2003) "Effects of Habitat Fragmentation on the Genetic Variability of Silvery Marmosets *Mico argentatus*" pp. 17-28, in Marsh, L.K. (ed) "*Primates in Fragments: Ecology and Conservation*" Springer

<sup>38</sup> IUCN page for "*Mico argentatus*": <http://www.iucnredlist.org/details/41520/0>

- <sup>39</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>
- <sup>40</sup> Ferrari, S.F. (1993) "Ecological differentiation in the Callitrichidae" pp. 314-328, in Rylands, A.B. (ed) "*Marmosets and Tamarins: Systematics, Behaviour, and Ecology*" Oxford University Press
- <sup>41</sup> Alvares, C.A., J.L. Stape, P.C. Sentelhas, J.L. de Moraes Goncalves, and G. Aparovek (2013) "Koppen's climate classification map for Brazil" *Meteorologische Zeitschrift* vol. 22 (6), pp.711-728
- <sup>42</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>
- <sup>43</sup> Veracini, C. (2009) "Habitat Use and Ranging Behavior in the Silvery Marmoset (*Mico argentatus*) at Caxiuana National Forest (Eastern Brazilian Amazonia)" pp. 221-240, in Ford, S.M., L.M. Porter, and L.C. Davis (eds) *The Smallest Anthropoids: the Marmoset/Callimico Radiation* Springer
- <sup>44</sup> Digby, L.J., S.F. Ferrari, and W. Saltzman (2007) "Callitrichines: The Role of Competition in Cooperatively Breeding Species" pp. 91-107, in Campbell, C., A. Fuentes, K.C. MacKinnon, M. Panger, and S. Bearder (eds) "Primates in Perspective" Oxford University Press
- <sup>45</sup> Ferrari, S.F., and M.A. Lopes Ferrari (1989) "A Re-Evaluation of the Social Organisation of the Callitrichidae, with Reference to the Ecological Differences between Genera" *Folia Primatol* vol 52: pp. 132-147
- <sup>46</sup> Dunbar, R.I.M. (1995) "The mating system of callitrichid primates: 1. Conditions for the coevolution of pair bonding and twinning" *Animal Behaviour* vol.50, pp. 1057-1070
- <sup>47</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>
- <sup>48</sup> Digby *et al* (2007), *op. cit.*
- <sup>49</sup> Garber, P.A. (1993) "Feeding Ecology and Behaviour of the genus *Saguinus*" pp. 273-295, in Rylands, A.B. (ed) "*Marmosets and Tamarins: Systematics, Behaviour, and Ecology*" Oxford University Press
- <sup>50</sup> Hubrecht, R., and J. Kirkwood (2010) "*The UFAW Handbook on the Care and Management of Laboratory and Other Research Animals*" Universities Federation for Animal Welfare

- **Provide information on the reproductive biology of the species**

In callitrichids in general, female sexual maturity is attained between 12 and 17 months of age, and in males 13 to 25 months.<sup>51</sup> The Animal Aging and Longevity Database gives (without reference) the average age of sexual maturity for Silvery Marmosets specifically as being 304 days for females, and 334 days for males.<sup>52</sup> Reproductive suppression of females other than the dominant female is normal in callitrichid groups.<sup>53,54</sup> As in all Primates, males and females are distinct sexes (i.e. not hermaphroditic, and parthenogenetic births are not possible), and they cannot change sex.<sup>55</sup>

Uniquely amongst higher Primates, all callitrichids typically produce litters of non-identical twins, although births can also less commonly be of just a single baby, or of three or very occasionally four babies (triplets or quadruplets). However, only in rare circumstances would more than two babies survive.<sup>56</sup>

There are no seasonal distinctions observed for births for most species of callitrichids (the Lion Tamarins *Leontopithecus spp* excepted), with reproduction being possible throughout the year.<sup>57</sup> In marmosets there are usually two litters per year, both in captivity and in the wild.<sup>58,59</sup> Females can conceive again within two to four weeks of giving birth.<sup>60</sup> The gestation period for marmosets is about 145 days or 20 weeks.<sup>61</sup>

In captivity nest-boxes are routinely provided for callitrichids, but animals in the wild do not normally use cavities for either sleeping or breeding.<sup>62</sup>

Hybridisation in callitrichids, especially in marmosets, is known to occur in the wild where the distributions of two related species meet, creating "hybrid zones".<sup>63,64</sup> Indeed, at least one species

(Wied's Marmoset *Callithrix kuhli*) is thought to be the result of natural hybridisation in the past.<sup>65</sup> Probably all marmoset hybrids would be fertile.<sup>66</sup> With regards to Silvery Marmosets specifically, they have been recorded as hybridising with the Common Marmoset *Callithrix jacchus* in captivity.<sup>67,68</sup>

There is no possibility of Silvery Marmosets hybridising with native Australian mammals, as there are no Primate species native to Australia.

<sup>51</sup> Digby, L.J., S.F. Ferrari, and W. Saltzman (2007) "Callitrichines: The Role of Competition in Cooperatively Breeding Species" pp. 91-107, in Campbell, C., A. Fuentes, K.C. MacKinnon, M. Panger, and S. Bearder (eds) "*Primates in Perspective*" Oxford University Press

<sup>52</sup> "Animal Aging and Longevity Database":

[http://genomics.senescence.info/species/entry.php?species=Mico\\_argentatus](http://genomics.senescence.info/species/entry.php?species=Mico_argentatus)

<sup>53</sup> Digby *et al* (2007), *op. cit.*

<sup>54</sup> Sodaro, V. and N. Saunders (eds) (1999) "Callitrichid Husbandry Manual" AZA Neotropical Primate Taxon Advisory Group: Chicago Zoological Park

<sup>55</sup> Napier, J.R. and P.H. Napier (1985) "*The Natural History of Primates*" M.I.T. Press

<sup>56</sup> Digby *et al* (2007), *op. cit.*

<sup>57</sup> Sodaro and Saunders (1999), *op. cit.*

<sup>58</sup> Digby *et al* (2007), *op. cit.*

<sup>59</sup> Sodaro and Saunders (1999), *op. cit.*

<sup>60</sup> Digby *et al* (2007), *op. cit.*

<sup>61</sup> Sodaro and Saunders (1999), *op. cit.*

<sup>62</sup> Sodaro and Saunders (1999), *op. cit.*

<sup>63</sup> Arnold, M.L. and A. Meyer (2006) "Natural hybridization in primates: One evolutionary mechanism" *Zoology*, vol. 109 (4), pp. 261-276

<sup>64</sup> Malukiewicz, J., V. Boere, L.F. Fuzessy, A.D. Grativol, J.A. French, I de Oliveira e Silva, L.C.M. Pereira, C.R. Ruiz-Miranda, Y.M. Valenca, and A.C. Stone (2014) "Hybridization Effects and Genetic Diversity of the Common and Black-tufted Marmoset (*Callithrix jacchus* and *Callithrix penicillata*) Mitochondrial Control Region" *American Journal of Physical Anthropology* vol. 155 (4), pp. 522-536

<sup>65</sup> Arnold and Meyer (2006), *op. cit.*

<sup>66</sup> Coimbra-Filho, A. F., A. Pissinatti, and A.B. Rylands (1993) "Experimental multiple hybridism among *Callithrix* species from eastern Brazil" pp. 95-120, in Rylands, A.B. (ed) "*Marmosets and Tamarins: Systematics, Behaviour, and Ecology*" Oxford University Press

<sup>67</sup> English, W.L. (1932) "Exhibition of living hybrid marmosets (*Hapale jacchus*, *Hapale argentata*)" *Proceedings of the Zoological Society of London*, vol. 102 (4), p. 1079

<sup>68</sup> Hill, W.C.O. (1961) "Hybridisation in marmosets" *Proceedings of the Zoological Society of London*, vol. 137 (2), pp. 321-322

- **Provide information on whether the species has established feral populations**

The Silvery Marmoset has never established wild breeding populations outside of its natural range.<sup>69</sup> Within its natural range it is not considered a pest in any economic way.<sup>70</sup>

The only callitrichids reported by Long (2003)<sup>71</sup> as being introduced to the wild in a foreign country or re-introduced within their natural ranges are the Cottontop Tamarin *Saguinus oedipus* and the Golden Lion Tamarin *Leontopithecus rosalia*, both as re-introductions within their natural ranges, and the Common Marmoset *Callithrix jacchus* as introductions within Brazil, to Guanabara in c.1900 and the city of Rio de Janeiro in the mid-20th century. In no cases was damage to humans or the



environment noted by Long. Malukiewicz *et al* (2014) note that the introduced population in Rio de Janeiro is actually a hybrid swarm formed from introductions of two species, the Common Marmoset *Callithrix jacchus* and the Black-tufted Marmoset *Callithrix penicillata*.<sup>72</sup>

<sup>69</sup> Long, J.L. (2003) "Introduced Mammals of the World" CSIRO

<sup>70</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>

<sup>71</sup> Long (2003), *op. cit.*

<sup>72</sup> Malukiewicz, J., V. Boere, L.F. Fuzessy, A.D. Grativol, J.A. French, I de Oliveira e Silva, L.C.M. Pereira, C.R. Ruiz-Miranda, Y.M. Valenca, and A.C. Stone (2014) "Hybridization Effects and Genetic Diversity of the Common and Black-tufted Marmoset (*Callithrix jacchus* and *Callithrix penicillata*) Mitochondrial Control Region" *American Journal of Physical Anthropology* vol. 155 (4), pp. 522-536

- **Environmental risk assessments of the species**

The Silvery Marmoset is not included in the Vertebrate Pests Committee's 2007 "List Of Exotic Vertebrate Animals In Australia".<sup>73</sup> Of the callitrichid species listed in the document, the Common Marmoset *Callithrix jacchus* is assigned a threat rating of "2/extreme", while the remaining listed species - the Pigmy Marmoset *Cebuella [Callithrix] pygmaea*, Golden Lion Tamarin *Leontopithecus rosalia*, Black Lion Tamarin *Leontopithecus chrysopygus*, Cottontop Tamarin *Saguinus oedipus*, Red-handed Tamarin *Saguinus midas*, and Emperor Tamarin *Saguinus imperator* - are assigned a threat rating of "2/Serious".

The number "2" in the threat rating is used to denote "limited to statutory zoos or endorsed special collections".

The rating of "serious" is qualified as "These animals may be introduced and/or should be kept only in collections approved by the relevant State/Territory authority as being primarily kept for (1) public display and education purposes, and/or for (2) genuine scientific research approved by the relevant State/Territory authority, and as meeting Best Practice for the purposes of keeping the species concerned".

The rating of "extreme" is qualified as "These animals should not be allowed to enter, nor be kept in any State or Territory. (Special consideration may be given to scientific institutions on a case by case basis.) Any species that has not been assessed previously should be considered to be in the Extreme Threat Category and should be treated accordingly, until a risk assessment is conducted."

It should be noted that almost every species of exotic mammal listed in the document has been categorised as either "extreme" or "serious".

Quarantine requirements for live Primates have been established by Biosecurity Australia, and would cover Silvery Marmosets if these were to be imported.<sup>74</sup>

Seven species of callitrichids are already included on the list of exotic zoo animals allowed to be imported into Australia, including the Common Marmoset *Callithrix jacchus* and Pigmy Marmoset *Cebuella pygmaea* (listed as *Callithrix pygmaea*), three species of *Saguinus* tamarins (the Emperor Tamarin *Saguinus imperator*, Red-handed Tamarin *Saguinus midas*, and Cottontop Tamarin *Saguinus oedipus*), and two species of *Leontopithecus* tamarins (the Golden Lion Tamarin *Leontopithecus rosalia* and the Black Lion Tamarin *Leontopithecus chrysopygus*).<sup>75</sup>

<sup>73</sup> Vertebrate Pests Committee "List of Exotic Vertebrate Animals in Australia":  
<https://www.pestsmart.org.au/wp-content/uploads/2010/03/VPCListJuly2007.pdf>

<sup>74</sup> Australian Government "Captive non-human primates" (2017):  
<http://www.agriculture.gov.au/biosecurity/risk-analysis/animal/captive-non-human-primates>

<sup>75</sup> Australian Government "List of Specimens taken to be Suitable for Live Import" (2017):  
<https://www.legislation.gov.au/Details/F2017C00434>

- **Assess the likelihood that the species could establish a breeding population in Australia**

The likelihood of Silvery Marmosets establishing a breeding population in Australia outside effective human control is low if based on historical data. There are no wild populations of Silvery Marmosets established outside their natural range,<sup>76</sup> and despite callitrichids being common in zoos, laboratories, and in private trade throughout the world, the only wild-introduced populations of any species are either deliberate re-introductions to their former range for conservation purposes (e.g. the Golden Lion Tamarin *Leontopithecus rosalia*) or, in the cases of the Common Marmoset *Callithrix jacchus* and Black-tufted Marmoset *Callithrix penicillata*, to non-native parts of their native country of origin (Brazil) via a large-scale pet trade in these species.<sup>77,78</sup>

Numerous species of marmosets and tamarins have been held in Australian zoos and laboratories over the last hundred years. Currently there are over 300 animals of six species of callitrichids held in Australian zoos as (contained) breeding populations.<sup>79</sup> Despite this long history and the population figures, no species of callitrichid has ever formed a wild population in Australia via escaped or released animals.

Callitrichids in general are omnivorous. Their diet includes various animal components such as invertebrates and small herptiles (lizards and frogs); and plant components such as nectar, flowers and fruits but excluding leaves and bark.<sup>80</sup> However many marmoset species - including the Silvery Marmoset - are obligate exudativores, with the dominant part of the diet being plant exudates (i.e. tree sap), which for the purposes of collecting they have specialised teeth for gouging holes in trunks (contrary to the tamarins *Saguinus* and *Leontopithecus*, which readily feed on available plant exudates but do not gouge bark to induce the flow, and in which the gut is not specifically-adapted for the digestion of exudates).<sup>81,82,83,84</sup> Because plant saps are high in carbohydrates but low in protein, all exudativorous mammals also eat a lot of insects or/and fruit.<sup>85</sup> Sap-feeding is not limited to any particular species of plant.<sup>86</sup> In captivity exudativorous marmosets will even dig holes into dry-wood fixtures (e.g. cage frames) in search of sap.<sup>87</sup> The ability to feed on plant exudates allows marmosets to inhabit seasonal forests where fruits are absent for large parts of the year, and also to avoid ecological competition with other Primate species.<sup>88</sup> In one study of Silvery Marmosets, 59% of the group's foraging-time was spent feeding on exudates, 36% on other plant material, and only 5% on animal prey (insects).<sup>89</sup>

Because Silvery Marmosets feed largely on exudates and insects they would find food easily in most habitats in Australia. Their exudativory is also directly comparable to the feeding habits of Australian possums of the family Petauridae. Marsupials listed as being obligate exudativores by Cabana *et al* (2017)<sup>90</sup> include the Sugar Glider *Petaurus breviceps* (29-55% of foraging-time spent on exudates), Yellow-bellied Glider *Petaurus australis* (59-91%), Squirrel Glider *Petaurus norfolcensis* (59%), Leadbeater's Possum *Gymnobelideus leadbeateri* (29-77%), and Striped Possum *Dactylopsila trivirgata* (26%). The endangered Mahogany Glider *Petaurus gracilis* is listed as being an opportunistic gum-feeder, with the foraging-time spent on exudates being only "minor".



In their natural range, the Silvery Marmoset is found in the lowland tropics of northeastern Brazil, less than 100 metres above sea-level, where there is a monsoonal climate.<sup>91</sup> Annual average temperatures are above 26 degrees Celsius, and the annual rainfall is 2800-3100mm.<sup>92</sup> As with all callitrichids, they are arboreal and cannot survive in treeless habitats (grasslands, desert, etc). However they are adaptable, being found in a wide range of forest types, including primary forest, secondary forest, open forest, and remnant forest patches in savannah, as well as in plantations.<sup>93</sup> Related species such as the Common Marmoset *Callithrix jacchus* are well-documented as being able to live easily in human environments such as gardens and city parks.<sup>94</sup> The Silvery Marmoset's primary diet of tree sap means that they are not dependent on rainfall (because of the water content in the sap itself). In fact the overall distribution of marmoset species seems linked more to the availability of additional invertebrate prey (for protein) than to rainfall.<sup>95</sup> Although in the wild state marmosets are tropical, in captivity they display no discomfort to cold weather, even coping with snowy conditions so long as they have dry and warm retreats.<sup>96</sup> Wild-living animals do not necessarily utilise cavities for shelter, however, so would likely not be able to survive low temperatures or the lack of invertebrate prey during winters in temperate climates.

Callitrichids have a very different reproductive strategy than that of other higher Primates (monkeys and apes), having evolved a high birth-rate combined with a relatively short lifespan. For the higher Primates a single offspring is the norm, with a long rearing period, meaning births occur only at periods of once a year to once every several years; and the lifespan of individual animals is typically many decades long.<sup>97</sup> In contrast, marmosets and tamarins typically produce litters of two offspring which are weaned and become independent quickly, with two litters per year being normal for a breeding female.<sup>98,99</sup> The lifespan of individuals is also relatively short compared to other higher Primates, usually less than ten years on average.<sup>100</sup>

These factors potentially could increase the likelihood for callitrichids such as the Silvery Marmoset to establish wild populations if escaped or released, if compared to other species of Primates.

In the wild state, callitrichids including the Silvery Marmoset are preyed upon by birds of prey, snakes, and predatory mammals (Felidae, Mustelidae, Procyonidae).<sup>101</sup> Because of their very small size they are a potential prey item for more predatory species than is the case for the larger Primates. Partly this is combated by group-living and a relatively high reproductive output.<sup>102</sup> In Australia a similar suite of predators is available in terms of birds of prey and large snakes, although the number of mammalian predators is much more restricted (primarily quolls and feral cats; foxes are terrestrial and would have no impact on wild-living marmosets).

The obligate exudativorous (sap-feeding) diet of Silvery Marmosets allows them to live alongside other Primates without competition, including the similarly-sized tamarins (*Saguinus spp*) which are not adapted to feeding on plant exudates other than opportunistically.<sup>103</sup> In general terms exudativorous marmoset species do not live sympatrically, although they may overlap where the distributional ranges meet.<sup>104</sup> Exudativory also allows Silvery Marmosets to live in seasonal environments where fruit is unavailable for part or even most of the year.<sup>105</sup> Callitrichids are the only obligate exudativorous mammals in South America so there is no competition for this food source in their native range, whereas in Australia there are several species of possums (Petauridae) which are obligate exudativores.<sup>106</sup>

Silvery Marmosets in Australia would be legally restricted to licenced holders (i.e. zoos) and thus importation of additional animals past an initial import would likely not result in any increase in risk of the establishment of wild populations via escape or release. Numerous species of marmosets and tamarins have been held in Australian zoos and laboratories over the last hundred years, and currently there are over 300 animals of six species of callitrichids held in Australian zoos as (contained) breeding populations.<sup>107</sup> Despite this long history and the population figures, no species of callitrichid has ever formed a wild population in Australia via escaped or released animals.

<sup>76</sup> Long, J.L. (2003) "*Introduced Mammals of the World*" CSIRO

<sup>77</sup> Long (2003), *op. cit.*

<sup>78</sup> Malukiewicz, J., V. Boere, L.F. Fuzessy, A.D. Grativol, J.A. French, I de Oliveira e Silva, L.C.M. Pereira, C.R. Ruiz-Miranda, Y.M. Valenca, and A.C. Stone (2014) "Hybridization Effects and Genetic Diversity of the Common and Black-tufted Marmoset (*Callithrix jacchus* and *Callithrix penicillata*) Mitochondrial Control Region" *American Journal of Physical Anthropology* vol. 155 (4), pp. 522-536

<sup>79</sup> Australian zoo census data from Zoo and Aquarium Association (ZAA)

<sup>80</sup> Digby, L.J., S.F. Ferrari, and W. Saltzman (2007) "Callitrichines: The Role of Competition in Cooperatively Breeding Species" pp. 91-107, in Campbell, C., A. Fuentes, K.C. MacKinnon, M. Panger, and S. Bearder (eds) "*Primates in Perspective*" Oxford University Press

<sup>81</sup> Digby *et al* (2007), *op. cit.*

<sup>82</sup> Francisco, T.M., D.R. Couto, J.C. Zanuncio, J.E. Serrao, I. de Oliveira Silva, and V. Boere (2014) "Vegetable Exudates as Food for *Callithrix* spp. (Callitrichidae): Exploratory Patterns" *PLoS One* 9 (11)

<sup>83</sup> Hogg, R.T., M.J. Ravosa, T.M. Ryan, and C.J. Vinyard (2011) "The functional morphology of the anterior masticatory apparatus in tree-gouging marmosets (Cebidae, Primates)" *Journal of Morphology* vol. 272 (7), pp. 833-849

<sup>84</sup> Dumont, E.R., J.L. Davis, I.R. Grosse, and A.M. Burrows (2011) "Finite element analysis of performance in the skulls of marmosets and tamarins" *Journal of Anatomy* vol. 218 (1), pp. 151-162

<sup>85</sup> Dumont *et al* (2011), *op. cit.*

<sup>86</sup> Digby *et al* (2007), *op. cit.*

<sup>87</sup> Coimbra-Filho, A.F., and R.A. Mittermeier (1976) "Exudate eating and tree-gouging in marmosets" *Nature* vol. 262, pp. 630-632

<sup>88</sup> Digby *et al* (2007), *op. cit.*

<sup>89</sup> Veracini, C. (1997) "O comportamento alimentar de *Callithrix argentata* (Linnaeus 1771) (Primata, Callitrichinae)" in Lisboa, P.L.B. (ed) *Caxiuana*, pp. 437-446 [in Portuguese]

<sup>90</sup> Cabana, F., E.S. Dierenfeld, Wirdateti, G. Donati, and K.A.I. Nekaris (2017) "Exploiting a readily available but hard to digest resource: A review of exudativorous mammals identified thus far and how they cope in captivity" *Integrative Zoology* vol 13 (1), pp. 94-111

<sup>91</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>

<sup>92</sup> Alvares, C.A., J.L. Stape, P.C. Sentelhas, J.L. de Moraes Goncalves, and G. Aparovek (2013) "Koppen's climate classification map for Brazil" *Meteorologische Zeitschrift* vol. 22 (6), pp.711-728

<sup>93</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>

<sup>94</sup> Malukiewicz *et al* (2013), *op. cit.*

<sup>95</sup> Digby *et al* (2007), *op. cit.*

<sup>96</sup> Mallinson, J.C.C. (1971) "Observations on the Breeding of Red-handed Tamarin, *Saguinus (=Tamarin) midas* (Linnaeus, 1758) with comparative notes on other species of Callitrichidae (=Hapalidae) breeding in captivity" *Annual Report 1971: Durrell Wildlife Conservation Trust*, pp. 19-31

<sup>97</sup> Napier, J.R. and P.H. Napier (1985) "*The Natural History of Primates*" M.I.T. Press

<sup>98</sup> Dunbar, R.I.M. (1995) "The mating system of callitrichid primates: 1. Conditions for the coevolution of pair bonding and twinning" *Animal Behaviour* vol.50, pp. 1057-1070

<sup>99</sup> Sodaro, V. and N. Saunders (eds) (1999) "Callitrichid Husbandry Manual" AZA Neotropical Primate Taxon Advisory Group: Chicago Zoological Park

<sup>100</sup> Sodar and Saunders (1999), *op. cit.*

<sup>101</sup> Digby *et al* (2007), *op. cit.*

<sup>102</sup> Digby *et al* (2007), *op. cit.*

<sup>103</sup> Digby *et al* (2007), *op. cit.*

<sup>104</sup> Mittermeier, R.A., A.B. Rylands, D.E. Wilson (eds) (2013) "*Handbook of the Mammals of the World, volume 3: Primates*" Lynx Edicions

<sup>105</sup> Digby *et al* (2007), *op. cit.*

<sup>106</sup> Cabana *et al* (2017), *op. cit.*

<sup>107</sup> Australian zoo census data from Zoo and Aquarium Association (ZAA)

- **Provide a comprehensive assessment of the potential impact of the species should it become established in Australia**

A. Does the species have similar niche/living requirements to native species?

Silvery Marmosets are small, arboreal, group-living, diurnal mammals which feed primarily on plant exudates (tree sap), other plant material (flowers, fruits, etc), and insects. They are restricted to areas with extensive tree cover (i.e. continuous forest or within forest strips/patches).<sup>108</sup> Although they utilise nest-boxes in captivity, in the wild they generally sleep on branches or amongst epiphytes rather than in tree holes.<sup>109</sup> Insect prey is obtained mostly by searching amongst plants and leaves for hidden insects.<sup>110</sup> Tree sap is obtained by gouging holes in tree trunks, in sites which are regularly visited through the group's territory.<sup>111</sup>

In Australia almost all the native mammals are nocturnal or crepuscular,<sup>112</sup> so would not be directly in competition with Silvery Marmosets should a wild population become established. The exudativorous diet of Silvery Marmosets is directly comparable to that of most of the species in the possum family Petauridae. Marsupials listed as being obligate exudativores by Cabana *et al* (2017)<sup>113</sup> include the Sugar Glider *Petaurus breviceps* (29-55% of foraging-time spent on exudates), Yellow-bellied Glider *Petaurus australis* (59-91%), Squirrel Glider *Petaurus norfolcensis* (59%), Leadbeater's Possum *Gymnobelideus leadbeateri* (29-77%), and Striped Possum *Dactylopsila trivirgata* (26%). The endangered Mahogany Glider *Petaurus gracilis* is listed as being an opportunistic gum-feeder, with the foraging-time spent on exudates being only "minor". However, all these species are strictly nocturnal<sup>114</sup> whereas Silvery Marmosets are strictly diurnal so there would be no interspecific conflict over feeding sites, and plant exudates are a limitless product in forest environments. The tables in Cabana *et al* also show that the Common Marmoset *Callithrix jacchus* and Pigmy Marmoset *Cebuella pygmaea*, both species currently present in and allowed to be imported into Australia, are likewise obligate exudativores.

B. Is the species susceptible to, or capable of transmitting any pests or diseases?

Silvery Marmosets can be carriers of external parasites such as ticks and internal parasites such as nematodes, all of which can be easily and effectively treated/removed before undergoing quarantine. There are a number of Zoonoses (protozoal, fungal and bacterial infections) transferrable in either direction between humans and non-human Primates, and these are well-covered in the medical literature due to the widespread use of Primates - including marmosets - in laboratories where they are used for studies into human diseases. Few zoonoses are of concern in

non-wild (i.e. captive-bred) animals. New World Primates do not carry or transmit Herpes B which is of a concern in Old World macaques (*Macaca spp*). The Princeton University datasheet here briefly covers those Zoonoses associated with marmosets: <https://ehs.princeton.edu/laboratory-research/animal-research-health-and-safety/zoonotic-disease-information/zoonoses-associated-new-world-monkeys>

Biosecurity Australia has an existing comprehensive set of quarantine requirements for the importation of live Primates, which covers disease control.

#### C. Probable prey/food sources.

Silvery Marmosets feed largely on plant exudates (tree sap), other plant material (flowers, fruit, etc), and insects. In one study of wild Silvery Marmosets, 59% of the group's foraging-time was spent feeding on exudates, 36% on other plant material, and only 5% on animal prey (insects).<sup>115</sup> Callitrichids in general have been recorded as feeding on small vertebrates (lizards and frogs) and birds' eggs,<sup>116,117</sup> although these items do not seem to have been specifically recorded for Silvery Marmosets.

Silvery Marmosets are versatile animals and do utilise human habitats in the wild so long as the habitat is of an arboreal nature (i.e. orchards and plantations).<sup>118</sup> They will not damage or feed upon commercial animal species, but do eat fruit/buds from fruiting plants and feed on sap from tree trunks. In their native range callitrichids are not considered a pest in any regard.<sup>119</sup>

#### D. Impacts on habitat and local environments.

If a wild population should become established there would be little impact on the local environment. Silvery Marmosets do not destroy vegetation or dig burrows. Callitrichids are not considered a pest in any respect in their native country, even when living in human habitats (e.g. plantations or gardens).<sup>120</sup> As partial fruit-eaters they can spread seeds via their faeces or potentially on their fur, which could include those of invasive or unwanted plant species. In the wild state they are known to be important seed dispersers of many fruiting species.<sup>121</sup>

#### E. Discuss any control/eradication programs that could be applied in Australia if the species escaped or were released.

If a wild population were to become established, detection and capture in continuous forest would probably be extremely difficult due to their small size and arboreal nature, although this may be offset somewhat by the species being group-living, noisy, and active by day. In human habitats (e.g. plantations or orchards) or in isolated forest patches they would probably be quite noticeable.

Wild callitrichids for scientific studies are captured using elevated live-traps, although this is only of use for small individual numbers of live-captures. Shooting and trapping would likely be the most appropriate options if a wild population needed to be controlled or eradicated.

#### F. Behaviours that cause environmental degradation.

The Silvery Marmoset does not have any behaviours or physical attributes which could cause environmental degradation. Based on the known ecology of callitrichids, they do not impact the ground, dig burrows, or damage or pollute waterways.<sup>122,123</sup>

#### G. Impacts on primary industries.

An established wild population of Silvery Marmosets would have little or no impact on primary industries such as farming or agriculture. In their native ranges callitrichids are not considered to be pests in any regard, even when living in commercial tree areas (plantations and orchards).<sup>124</sup> They do feed on fruit and buds/flowers as part of their diet, which could bring conflict with orchardists although this seems to not be the case in South America. As obligate exudativores, the diet of Silvery Marmosets requires them to wound trees to induce the flow of sap. This does not appear to be to the detriment of the trees - a comparison would be to the feeding habits of Petauridae possums native to Australia, although these species feed mainly on exudates from non-commercial eucalyptus and wattle trees.<sup>125</sup> The wounds are in the bark layer and do not affect the health or timber quality of commercial trees.

#### H. Damage to property.

The Silvery Marmoset is a very small arboreal Primate, and does not damage property.

#### I. Is the species a social nuisance or danger?

The Silvery Marmoset is not a species which would cause a social nuisance. In the native state callitrichids are not considered to be a pest in any regard.<sup>126</sup>

#### J. Describe any potentially harmful characteristics of the species.

All callitrichids (marmosets and tamarins) have small sharp claws and sharp teeth, and are capable of inflicting minor wounds on humans. However the very small size of the animals prevents serious injuries. The wearing of gloves as protection is recommended if the handling of live animals is required.<sup>127</sup>

There are numerous Zoonoses capable of being transmitted in either direction between humans and non-human Primates. The Princeton University datasheet here briefly covers Zoonoses associated with marmosets: <https://ehs.princeton.edu/laboratory-research/animal-research-health-and-safety/zoonotic-disease-information/zoonoses-associated-new-world-monkeys>

Hubrecht and Kirkwood (2010)<sup>128</sup> also covers Primate diseases in a wider scope.

Some common airborne human diseases such as measles and tuberculosis are easily spread to, and may be lethal to, marmosets. Zoonoses which can be spread from marmosets to humans under captive conditions are usually via the animals' faecal matter, such as *Shigella*, *Salmonella*, *Campylobacter* and *Yersinia* bacteria. Viruses such as Monkey Pox can also be carried by marmosets, although the Princeton datasheet notes that "it is unusual for these and other viruses to be present in purpose-bred animals." Further, Hubrecht and Kirkwood<sup>129</sup> state that "Captive-bred animals of known health status are less of a risk" [than wild-caught animals].

Most transmittable Zoonoses are not specific to marmosets (or, indeed, to Primates) but can be carried by any or many mammals.

Biosecurity Australia has an existing comprehensive set of quarantine requirements for the importation of live Primates, which covers disease control.

<sup>108</sup> Mittermeier, R.A., A.B. Rylands, D.E. Wilson (eds) (2013) "*Handbook of the Mammals of the World, volume 3: Primates*" Lynx Edicions

<sup>109</sup> Sodaro, V. and N. Saunders (eds) (1999) "Callitrichid Husbandry Manual" AZA Neotropical Primate Taxon Advisory Group: Chicago Zoological Park

<sup>110</sup> Mittermeier *et al* (2013), *op. cit.*

<sup>111</sup> Hogg, R.T., M.J. Ravosa, T.M. Ryan, and C.J. Vinyard (2011) "The functional morphology of the anterior masticatory apparatus in tree-gouging marmosets (Cebidae, Primates)" *Journal of Morphology* vol. 272 (7), pp. 833-849

<sup>112</sup> Menkhorst, P. and F. Knight (2010) "*A Field Guide to the Mammals of Australia*" Oxford University Press

<sup>113</sup> Cabana, F., E.S. Dierenfeld, Wirdateti, G. Donati, and K.A.I. Nekaris (2017) "Exploiting a readily available but hard to digest resource: A review of exudativorous mammals identified thus far and how they cope in captivity" *Integrative Zoology* vol 13 (1), pp. 94-111

<sup>114</sup> Menkhorst and Knight (2010), *op. cit.*

<sup>115</sup> Veracini, C. (1997) "O comportamento alimentar de *Callithrix argentata* (Linnaeus 1771) (Primata, Callitrichinae)" in Lisboa, P.L.B. (ed) *Caxiuana*, pp. 437-446 [in Portuguese]

<sup>116</sup> Mittermeier *et al* (2013), *op. cit.*

<sup>117</sup> Digby, L.J., S.F. Ferrari, and W. Saltzman (2007) "Callitrichines: The Role of Competition in Cooperatively Breeding Species" pp. 91-107, in Campbell, C., A. Fuentes, K.C. MacKinnon, M. Panger, and S. Bearder (eds) "*Primates in Perspective*" Oxford University Press

<sup>118</sup> IUCN page for "Mico argentatus": <http://www.iucnredlist.org/details/41520/0>

<sup>119</sup> Digby *et al* (2007), *op. cit.*

<sup>120</sup> Digby *et al* (2007), *op. cit.*

<sup>121</sup> Mittermeier *et al* (2013), *op. cit.*

<sup>122</sup> Mittermeier *et al* (2013), *op. cit.*

<sup>123</sup> Digby *et al* (2007), *op. cit.*

<sup>124</sup> Digby *et al* (2007), *op. cit.*

<sup>125</sup> Lindenmayer, D. (2002) "*Gliders of Australia: A Natural History*" UNSW Press

<sup>126</sup> Digby *et al* (2007), *op. cit.*

<sup>127</sup> Hubrecht, R., and J. Kirkwood (2010) "*The UFAW Handbook on the Care and Management of Laboratory and Other Research Animals*" Universities Federation for Animal Welfare

<sup>128</sup> Hubrecht and Kirkwood (2010), *op. cit.*

<sup>129</sup> Hubrecht and Kirkwood (2010), *op. cit.*

- **What conditions or restrictions could be applied to reduce any potential for negative impacts of the species?**

Importation and transfer of Silvery Marmosets would be limited exclusively to recognised zoological facilities as licensed by their respective states and territories. As a containment species, Silvery Marmosets would be specifically excluded from import by or transfer to private individuals to keep as private pets.



Measures to prevent breeding such as limiting importation to a single sex or to de-sexed individuals would prevent imported specimens being used to conserve the species in Australian zoos in the future.

- **Summary of proposed activity**

Silvery Marmosets will be used in a variety of ways:

- for captive breeding programmes, in cooperation with other licensed zoos, to further the conservation of the species in captivity;
- for public display as an ambassador for their species;
- to facilitate education of zoo visitors in a range of different areas of learning.

The proposed import would initially be of 3.3.0 individuals for three zoos. The intention of the importing facility is to hold 1.1 while the remaining pairs will be held at the other two facilities. The intention of importing three pairs of Silvery Marmosets is to help achieve and maintain genetic diversity for the species in the Australasian region. The intention is for all imported animals to be from separate bloodlines. Further imports may be undertaken to provide additional genetic stock.

The imported animals will all have been captive-bred in licenced overseas zoos eligible to export animals to Australia.

Individual animals will be contracepted to avoid unwanted breeding.

Planned breeding will be undertaken to preserve genetic diversity and in order to avoid producing surplus stock.

- **Guidelines on how species should be kept**

Silvery Marmosets are widely kept in zoos in Europe and North America, and captive care information is readily available in specific husbandry manuals for callitrichids (marmosets and tamarins). In Australia, the Zoo and Aquarium Association (ZAA) has general guidelines governing the well-being of zoo animals.

Transport of imported Silvery Marmosets would follow IATA Live Animal Regulations.

With respect to the importing facility, each imported Silvery Marmoset pair will be kept in a secure, aviary style mesh enclosure.

Each enclosure will measure a minimum of 20 square metres and be 3 metres high. Enclosures will be constructed of 25 x 25 x 2 galvanised steel weldmesh on a 40 x 40 x 2 galvanised steel frame.

The rear 1/3 of the enclosure [on the prevailing weather end] will be enclosed with a Colourbond® steel roof and walls. Within this area will be located a heated nightbox. Radiant heat lamps will also be located in this area.

The entire enclosure will be vegetated with non-toxic plants. Plentiful horizontal and vertical climbing opportunities will be provided. Drinking water will be provided *ad lib* in an above ground receptacle and there will be separate, elevated feed stations.

Enclosure substrate will be of pine bark and groundcover vegetation.

Keeper access to the enclosure will be through a lockable airlock and there will be no visitor access to the enclosure.

Visitor viewing will be from the front end only and visitors will be kept two metres back from the enclosure by a 1200 high stand-off fence.

The zoo premises have 24-hour live-in human security presence, and at night guard dogs patrol the grounds. The entire zoo property is enclosed within a security fence with lockable access gates.

- **State/Territory controls**

As the Silvery Marmoset is not currently kept in Australian zoos, and has not been kept in Australia at any time in the recent past, there are no specific assessments for the species under Australian state legislations. However several other callitrichid species (marmosets and tamarins) are covered.

\*The Australian Government's "List of Specimens taken to be Suitable for Live Import" lists seven other species of callitrichids (marmosets and tamarins) which can currently be imported under licence:

<https://www.legislation.gov.au/Details/F2017C00434>

\*In Queensland the *Exhibited Animals Act 2015* does not cover the Silvery Marmoset [or any species specifically] but allows a licence holder to "Exhibit and deal with animals listed on this authority in accordance with information assessed and approved in deciding the application and details listed on this authority". Six species of callitrichids are currently housed in Queensland zoos under this Act.

<https://www.legislation.qld.gov.au/view/pdf/asmade/sl-2003-0117>

\*In New South Wales the *Non-Indigenous Animals Regulation 2012* does not include the Silvery Marmoset but lists four other species of callitrichids (marmosets and tamarins) in Category 2, and five other callitrichid species in Category 3a. Animals in both of these Categories are restricted to licenced facilities. This regulation allows these species to be kept in zoos with a permit to be issued by the relevant state authority for possession of the species.

<https://www.legislation.nsw.gov.au/regulations/2012-405.pdf>

\*In Victoria the *Catchment and Land Protection Act 1994* does not cover the Silvery Marmoset specifically but six other species of callitrichids (marmosets and tamarins) are listed in Schedule 2 as Controlled Pest Animals, which allows them to be kept in zoos with a permit to be issued by the relevant state authority for possession of the species. Species not specifically listed in Schedule 2 are automatically included in Schedule 1 as Prohibited Pest Animals.

[http://www.legislation.vic.gov.au/domino/Web\\_Notes/LDMS/LTObject\\_Store/ltobjst10.nsf/DDE300B846EED9C7CA257616000A3571/1B88C214FAD7CE39CA2581F7000236BB/\\$FILE/94-52aa057%20authorised.pdf](http://www.legislation.vic.gov.au/domino/Web_Notes/LDMS/LTObject_Store/ltobjst10.nsf/DDE300B846EED9C7CA257616000A3571/1B88C214FAD7CE39CA2581F7000236BB/$FILE/94-52aa057%20authorised.pdf)

<http://www.gazette.vic.gov.au/gazette/Gazettes2010/GG2010S399.pdf>

\*In South Australia the *Natural Resources Management Act 2004* does not cover the Silvery Marmoset specifically but seven other species of callitrichids (marmosets and tamarins) are listed in Category 1 of Schedule 1, which allows them to be kept in zoos with a permit to be issued by the relevant state authority for possession of the species.

[http://www.pir.sa.gov.au/\\_data/assets/pdf\\_file/0003/137460/Declaration\\_of\\_Animals\\_and\\_Plants\\_Jan\\_2015.pdf](http://www.pir.sa.gov.au/_data/assets/pdf_file/0003/137460/Declaration_of_Animals_and_Plants_Jan_2015.pdf)

\*In Western Australia the *Biosecurity and Agricultural Management Act 2007* does not cover the Silvery Marmoset specifically but seven other species of callitrichids (marmosets and tamarins) are listed in Category C1 as Prohibited Organisms, which allows them to be kept in zoos with a permit to be issued by the relevant state authority for possession of the species.

The *Biosecurity and Agricultural Management (Prohibited Organisms) Declaration 2013* is available here:

<https://www.agric.wa.gov.au/sites/gateway/files/BAM%20Decl%20s22%20%28Prohibited%20Organisms%29.pdf>

The Western Australian Organism List is searchable online for the most current results here:

<https://www.agric.wa.gov.au/organisms>

\*In Tasmania the *Nature Conservation Act 2002* does not cover the Silvery Marmoset specifically, but has two species of callitrichid (the Common Marmoset *Callithrix jacchus* and Cottontop Tamarin *Saguinus oedipus*) as Controlled Animals, which allow those two species to be kept in zoos with a permit to be issued by the relevant state authority for possession of the species.

<https://www.legislation.tas.gov.au/view/html/inforce/current/act-2002-063>

List of species which have been risk-assessed for Tasmania: <http://dpiw.tas.gov.au/wildlife-management/management-of-wildlife/wildlife-imports/species-risk-assessments>

\*There is no specific reference to Silvery Marmosets, nor apparently to callitrichids in general, in the legislation for the Northern Territory or the Australian Capital Territory.

Biosecurity Australia has an existing comprehensive set of quarantine requirements for the importation of live Primates, which would cover Silvery Marmosets should they be imported.

<http://www.agriculture.gov.au/biosecurity/risk-analysis/animal/captive-non-human-primates>

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